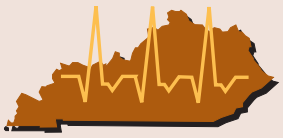


EQC

Environmental Quality Commission
Environmental Indicators Program
Reporting on Environmental Trends and Conditions in Kentucky.

1996 Trends Reports
- Safe Drinking Water
- Air Quality
- Waste Management
- Toxics
- Water Quality
- Natural Resources
- Resource Extraction

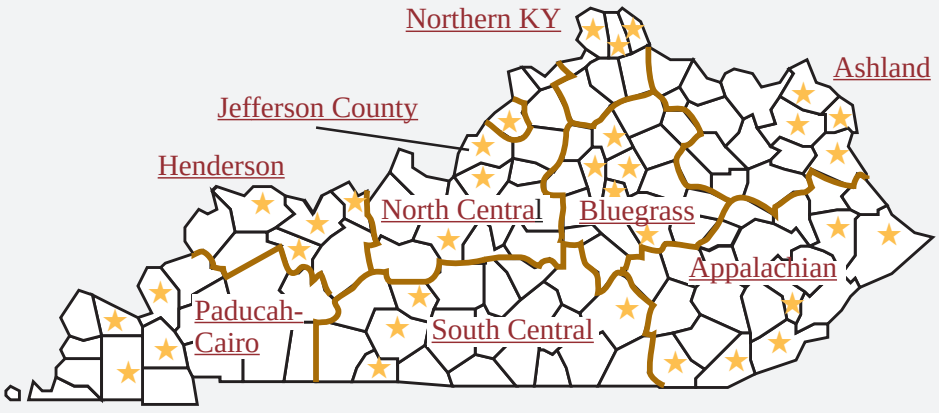
EQC is a seven-member citizen commission created under state law with a mission to monitor environmental trends and conditions, promote partnerships to improve and protect the environment, provide a public forum for the discussion of environmental issues, and advise state officials on environmental matters.

Air Quality

Efforts to clean up Kentucky's and the nation's air have been ongoing since the passage of the federal Clean Air Act of 1970. And the results have been dramatic. During the past two decades, concentrations of many air pollutants in Kentucky have declined, in one case by 97%.[1] But the job is far from over. Air pollution generated by industries — along with tailpipe emissions from an ever-growing number of automobiles and other sources — continue to contribute to environmental degradation and pose public health risks.

This *State of Kentucky's Environment* report will assess the state's progress in providing Kentuckians with clean, healthy air to breathe. This includes an analysis of data collected from 113 air quality monitors in 34 counties across the state. This monitoring network provides the best measure of statewide and regional concentrations of various air pollutants in Kentucky **(Figure 1)**. This report will also review air toxics emission trends, greenhouse gas and ozone-depleting chemical releases, as well as indoor air quality, which is ranked a high health risk in Kentucky.

Figure 1 Air Quality Control Regions and Monitored Sites★



★ *Monitored sites measuring one or more air pollutant operated by the KY Div. for Air Quality and the Jefferson County Air Pollution Control District. Source: KY Division for Air Quality*

Air Quality Improvements Continue Into the 1990s

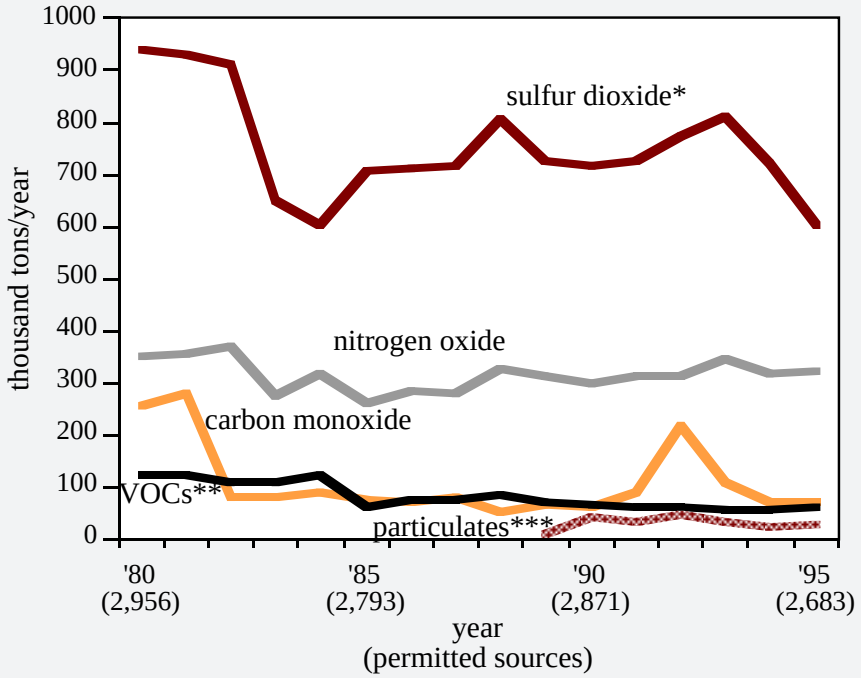
There are multiple sources that contribute to air pollution including industries, automobiles, and small businesses. The principal law enacted to control air pollution is the federal Clean Air Act of 1970, which was later amended in 1990. Most of the Clean Air Act provisions have focused on controlling six pollutants:

- ozone (ground-level)
- carbon monoxide (CO)
- sulfur dioxide (SO_2)
- nitrogen dioxide (NO_2)
- particulates (PM-10)
- lead[2]

Industrial emissions of some air pollutants have declined since 1980 **(Figure 2)**. For example, in 1995, sulfur dioxide emissions in Kentucky dropped 36% from 1980 levels largely due to the installation of scrubbers, pollution control devices used to remove sulfur dioxide, at 12 coal-fired power plants. Measures to curtail automobile tailpipe emissions have also contributed to improving air quality. Air quality trends show steady reductions in the concentrations of various air pollutants in Kentucky **(Figure 3)**. These improvements have been accomplished while our economy has grown, representing important progress in achieving economic growth while maintaining a safe environment.

Industrial emissions of some air pollutants have declined since 1980. For example, in 1995, sulfur dioxide emissions in Kentucky dropped 36% from 1980 levels largely due to the installation of scrubbers, pollution control devices used to remove sulfur dioxide, at 12 coal-fired power plants.

Figure 2 Air Pollutant Emissions from Permitted Sources in KY



*Note: Excludes Jefferson Co. data because the Jefferson Co. Air Pollution Control District was unable to provide data for all years displayed (see Figure 7). 1995 data preliminary. *Decline in SO_2 emissions during 1983-84 may be due to the shut down of TVA power plants for repairs and subsequent installation of scrubbers. **1980-88 VOC data represent total hydrocarbons. ***PM-10 particulate emission data collection began in 1989. Source: KY Division for Air Quality*

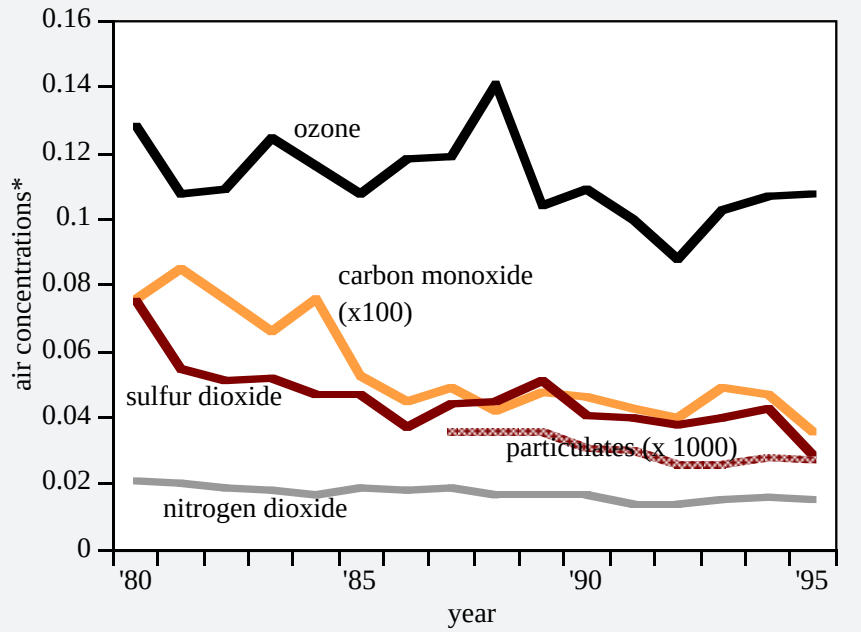
Air quality trends show steady reductions in the concentrations of various air pollutants in Kentucky. These improvements have been accomplished while our economy has grown, representing important progress in achieving economic growth while maintaining a safe environment.

Percent Change in Air Pollutant Concentrations

Ozone*	-5%
NO_2*	-27%
CO*	-42%
SO_2*	-29%
PM-10**	-18%

**Based on 10-year average air concentrations comparing 1976-85 and 1986-95. **Based on 4-year average air concentrations comparing 1988-91 and 1992-95.*

Figure 3 Air Concentrations of Pollutants in Kentucky



**Yearly air concentrations from state monitored sites based on the following: Ozone-second maximum one-hour average. CO-second maximum eight-hour average. NO_x and particulates (PM-10)-annual statewide averages. SO_2-second maximum, 24-hour average. Concentrations in parts per million for all pollutants except particulates, which are measured in micrograms per cubic meter. Source: KY Division for Air Quality*

Ozone Pollution Remains a Problem in Louisville & Northern KY

Of the six principal air pollutants, ground-level ozone has been the most difficult to control. Kentucky was among 35 states that experienced exceedances of the ozone pollution standard during 1995.[3] Ozone is produced when emissions of volatile organic compounds (VOCs), such as solvents and automobile exhaust, and nitrogen oxides (a by-product of combustion) react with sunlight. There are numerous sources that produce these "precursor" gases including manufacturing plants, coal-fired power plants, large industrial boilers, gas stations, and automobiles.

Of the six principal air pollutants, ground-level ozone pollution has been the most difficult pollutant to control. Kentucky was among 35 states that experienced exceedances of the ozone standard during 1995.[3]

The health effects from exposure to ozone can be serious, causing reduced lung function and exacerbation of asthma and other respiratory diseases. According to the American Lung Association, an estimated 432,516 people in Kentucky, or 11% of the state's population, suffer from lung cancer or chronic respiratory diseases such as asthma and emphysema that can be aggravated by exposure to ozone.[4] Ground-level ozone not only affects people with impaired respiratory systems, but healthy adults and children as well. Exposure to ozone for six to seven hours, even at low concentrations, can reduce lung function in healthy people during periods of moderate exercise. Ozone pollution can also damage crops and forest ecosystems.

Ozone formation is greatly influenced by weather conditions. The greatest number of ozone standard exceedances occurred during the hot summers of 1980, 1983, and 1988 **(Figure 4)**. Despite these fluctuations, there appears to be a general decline in statewide ozone levels as seen in **Figure 3**. Technologies to control VOC emissions such as catalytic converters on automobiles and the use of carbon absorption and thermal oxidation at industrial plants have led to a decrease in the number and severity of ozone standard exceedances in Kentucky. As a result, the U.S. Environmental Protection Agency (U.S. EPA) redesignated the Bluegrass and Ashland regions from nonattainment for ozone to attainment in 1995.

According to the American Lung Association, an estimated 432,516 people in Kentucky, or 11% of the state's population, suffer from lung cancer or chronic respiratory diseases that can be aggravated by exposure to ozone.[4]

Most regions of the state currently meet the national ozone standard **(Figure 5)**. However, ozone is still a problem in the urban airsheds of the Northern KY/Cincinnati region (which includes Boone, Campbell, and Kenton counties) and Jefferson County/Southern Indiana region which includes Jefferson and portions of Bullitt and Oldham counties **(Figure 6)**. Approximately 28% of Kentucky's population live in counties currently experiencing problems meeting the ozone standard.

Figure 4 Number of Days Ozone Standard Exceeded by Air Quality Control Region

	Bluegrass	N. KY	Henderson	Ashland	Jefferson	Paducah	N. Central	S. Central	Appalachian
1980	0	10	1	4	23	1	1	0	NM
1981	1	0	2	0	5	1	0	0	0
1982	0	1	0	3	4	0	0	0	0
1983	2	7	4	8	19	2	3	0	0
1984	0	1	0	7	11	0	0	0	NM
1985	0	1	1	3	1	0	0	0	NM
1986	3	1	2	3	2	2	3	0	NM
1987	2	3	2	8	6	0	2	1	NM
1988	5	15	12	12	7	5	12	5	NM
1989	0	1	0	1	4	0	0	0	NM
1990	1	0	3	4	1	0	2	0	NM
1991	0	0	0	3	0	0	2	0	NM
1992	0	0	0	0	0	0	0	0	0
1993	0	1	0	1	2	1	1	0	0
1994	0	0	2	2	1	0	0	0	0
1995	0	1	0	1	2	0	1	0	2

Note: Based on actual number of days in Kentucky that exceeded ozone standards as recorded at state air quality monitors. NM-not monitored. Source: KY Division for Air Quality

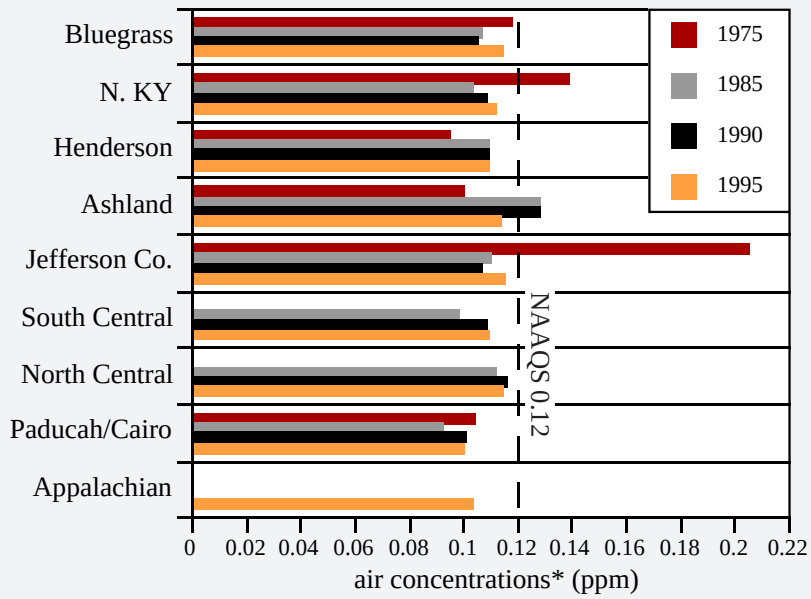
Most regions of the state currently meet the national ozone standard. However, ozone is still a problem in the urban airsheds of Northern Kentucky and Jefferson County.

Percent Change in Ozone Air Concentrations

Bluegrass	-7%
N. KY	-7%
Henderson	-6%
Ashland	-9%
Jefferson	-17%
Paducah	+2%
N. Central	+4%

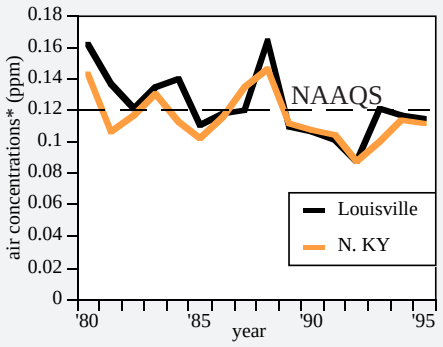
Based on 10-year average air concentrations comparing 1976-85 and 1986-95.

Figure 5 Regional Air Concentrations of Ozone



*Note: Selected years. *Yearly ozone air concentrations based on second maximum, one-hour average recorded at state monitored sites. Concentrations compared to the National Ambient Air Quality Standard (NAAQS). ppm-parts per million. Source: KY Division for Air Quality*

Figure 6 Louisville and N. KY Ozone Air Concentration Trends



**Yearly concentrations based on second maximum, one-hour average of ozone at state monitored sites. ppm-parts per million Source: KY Division for Air*

Plan to Reduce Ozone Pollution Implemented in Jefferson County

The Clean Air Act Amendments of 1990 requires that Kentucky develop plans to reduce VOC emissions ik8the Northern Kentucky and Jefferson County ozone nonattainment regions 15% by 1996 using 1990 emission levels as the baseline. These regions must also meet the ozone attainment standard of not more than one ozone standard exceedance each year over a three-year period at any one air quality monitor. Not meeting these requirements could mean a loss of federal highway construction funds and other sanctions. However, the U.S. EPA can grant extensions to provide regions additional time to meet the ozone standard.

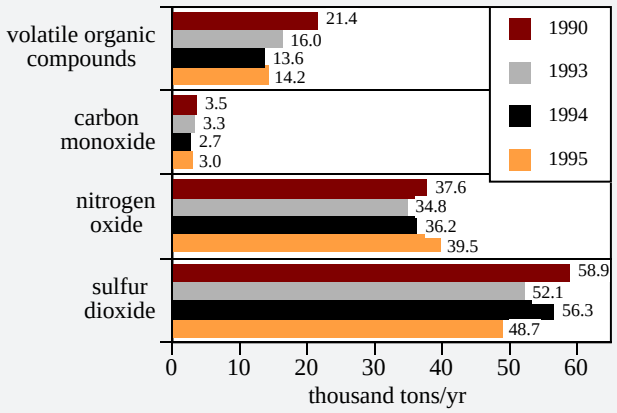
During 1995, 435,832 vehicles were tested in Jefferson County of which 32,030 required repairs and retesting to meet tailpipe emission requirements to help address the ozone pollution problem in the region. A total of 699 vehicles failed to pass the emissions test that year.

The Jefferson County Air Pollution Control District — the regulatory agency responsible for enforcing the Clean Air Act provisions in Jefferson County — has been working for the past 26 years to reduce VOC and other emissions to address ozone problems in the airshed. In 1984, the district initiated an automobile inspection program to control tailpipe emissions, which contribute to the ozone problem. During 1995, 435,832 vehicles were tested in Jefferson County of which 32,030 required repairs and retesting to meet tailpipe emission requirements to help address ozone pollution. A total of 699 vehicles failed to pass the emissions test that year. The district also required the installation of vapor controls at gasoline stations to reduce VOC emissions. In addition, the state required gas stations in Jefferson County to switch from selling conventional gasoline to reformulated gasoline (RFG),

a gasoline blend that, on average, reduces VOCs and air toxic emissions. In 1995, the first year RFG went on sale in Jefferson County, an estimated 350 million gallons of RFG were sold.

Industrial VOC emissions in Jefferson County have declined 34% between 1990 and 1994 **(Figure 7)**. The VOC reductions are attributed to plant closings as well as the County's Ozone Reduction Plan, which went into effect in 1992. The most recent plan calls for VOC reductions of 40.8 tons per day to achieve the 15% reduction by 1996. About 38% of the reductions will come from tightened vehicle inspections, 40% from a cap on large industrial sources that emit 50 tons or more a year, and 22% from a cap on smaller area sources such as gas stations and dry cleaners **(Figure 8)**. However, because of continued ozone standard exceedances during 1994 and 1995, the district proposed to go beyond the 15% VOC reduction goal. Additional VOC and nitrogen oxide reductions were implemented in 1995 and include emission limits at printing plants, further reductions at large sources, and strengthening the auto inspection program **(Figure 8)**.

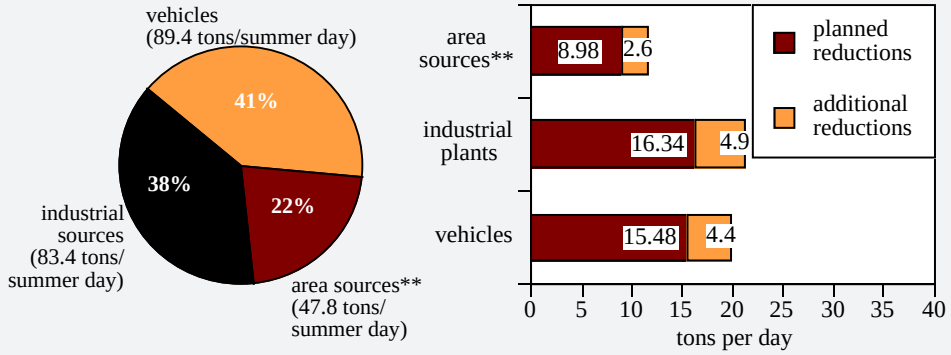
Figure 7 Industrial Emissions of Air Pollutants in Jefferson County



Note: Based on emissions reported by permitted sources. 1995 data preliminary. Data prior to 1990 and for 1992 not available.
Source: Jefferson County Air Pollution Control District

Industrial VOC emissions in Jefferson County have declined 34% between 1990 and 1995, according to data provided by the Jefferson County Air Pollution Control District. The reductions are attributed to plant closings as well as the County's Ozone Reduction Plan, which went into effect in 1992.

Figure 8 Jefferson Co. VOC Sources and Emission Reductions



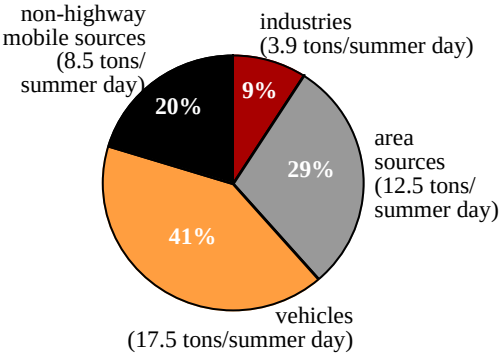
**Reductions of 30.61 tons/day of nitrogen oxide emissions are also planned over the next four years. **Area sources include gas stations, dry cleaners, and other nontraditional sources.*
Source: Jefferson County Air Pollution Control District

The most recent Jefferson County Ozone Reduction Plan calls for VOC reductions of 40.8 tons per day. About 38% of the reductions will come from tightened vehicle inspections, 40% from a cap on large industrial sources that emit 50 tons or more a year, and 22% from a cap on smaller area sources such as gas stations and dry cleaners.

U.S. EPA Issues Preliminary Denial to State's Request that Northern Kentucky be Reclassified to Attainment for Ozone

In 1993, the state submitted a 15% VOC reduction plan for Northern Kentucky ozone nonattainment area to the U.S. EPA. Because 41% of the VOC emissions in the region are from vehicles, the plan included an automobile inspection and maintenance program and the use of reformulated gasoline to address ozone pollution problems in the region.

N. KY VOC Sources[5]



Ozone violations in the Northern Kentucky region during 1995 have led the U.S. EPA to propose to deny the state's 1994 request to redesignate the region to attainment for ozone. If the request is officially denied, which is expected to occur in the near future, VOC reductions would be required Kenton, Campbell, and Boone counties.

However, in 1994 the region achieved compliance with the ozone standard, and the state requested that it be redesignated to attainment for ozone. The state later requested the U.S. EPA also allow the Northern KY region to opt-out of the RFG gas program, which was implemented in January 1995. But ozone violations in the region during 1995 have led the EPA to propose to deny the redesignation request. If the request is officially denied, which is expected to occur in the near future, VOC reductions would be required in Kenton, Campbell, and Boone counties.

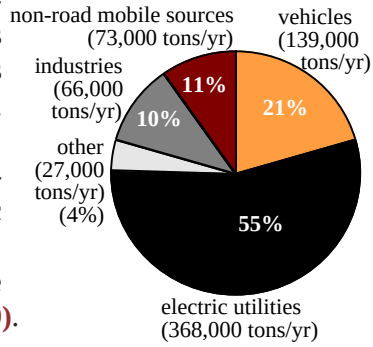
The U.S. EPA is currently reviewing the national ozone standard to determine if it is stringent enough to protect human health and the environment. Under consideration is the replacement of the 0.12 parts per million (ppm), one-hour average exposure standard with a 0.07-0.09 ppm, eight-hour standard. In addition to the new standard, the EPA is also considering a change in the number of ozone exceedances allowed under the new standard before triggering nonattainment status for a region. The U.S. EPA is expected to propose a new ozone standard sometime in 1996.[6]

State Ranks Eleventh in Nitrogen Dioxide Emissions

Nitrogen dioxide (NO_2) belongs to a family of highly reactive gases called nitrogen oxides (NO_x) — a brownish gas produced by fossil fuel combustion from sources such as cars and power plants. During 1994, 673,000 tons of nitrogen oxides were emitted to the air in Kentucky, ranking the state eleventh in the nation in NO_x emissions. This pollutant can irritate the lungs and lead to respiratory infections. NO_2 is also associated with atmospheric reactions that produce ozone and acid rain.

Air concentrations in all regions of Kentucky continue to remain below the national standard for NO_2 **(Figure 9)**.

NO_x Emissions in KY[7]



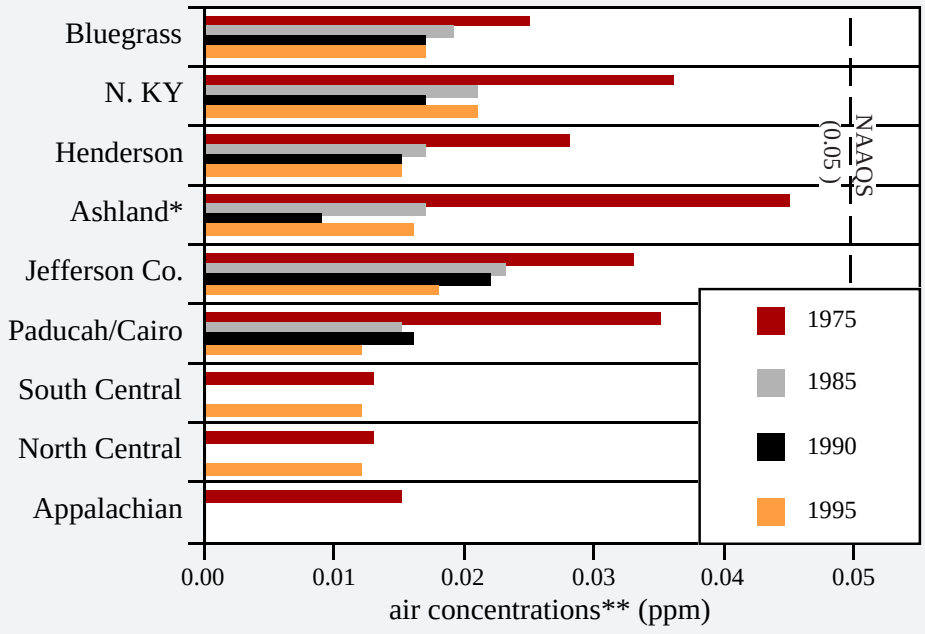
Air concentrations in all regions of Kentucky continue to remain below the national standard for nitrogen dioxide.

Percent Change in Nitrogen Dioxide Air Concentrations

Bluegrass	-5%
N. KY	-24%
Henderson	-20%
Ashland	-35%
Jefferson	-38%
Paducah	-29%

Based on 10-year average air concentrations comparing 1976-85 and 1986-95.

Figure 9 Regional Air Concentrations of Nitrogen Dioxide



*Note: Selected years. *There is no explanation for the 1990 air concentration average in the Ashland Region. This may be due to monitoring changes in the region that year. **Yearly average NO_x concentrations at state monitored sites. Concentrations compared to the National Ambient Air Quality Standard (NAAQS). ppm - parts per million. Source: KY Division for Air Quality*

Large Nitrogen Oxide Sources Must Begin to Reduce Emissions

A primary source of NO_x is fossil fuel combustion. In 1994, coal-fired power plants accounted for 55% of the NO_x emissions in Kentucky. The Clean Air Act Amendments of 1990 require large NO_x sources such as power plants to modify combustion to reduce emissions 30-40% below 1980 levels by the year 2000. Sources have the option to choose the method of compliance that best suits their needs. Some power plants in Kentucky have installed low NO_x burners, a more efficient combustion technology that can reduce NO_x emissions by 40-60% **(Figure 10).**

In Kentucky, total nitrogen oxide emissions from power plants increased 16% between the years 1980 and 1995 **(Figure 10)**. The Tennessee Valley Authority's (TVA) Paradise power plant in Muhlenberg County is one of the nation's largest power plant emitters of NO_x. According to EPA officials, the lack of NO_x reductions may be attributed to the delay in issuing final federal regulations governing NO_x emissions, the absence of an allowance market for NO_x reductions, and the hesitancy of industry to invest in controls until regulatory uncertainties are resolved.[8]

Figure 10 Nitrogen Oxide Emissions from Power Plants in KY

County	Facility	1980 tons	1990 tons	1995 tons	1980-95 % change
McCracken	TVA-Shawnee**	32,065	25,349	36,367	+13%
Muhlenberg	KY Utilities-Green	2,873	4,162	4,008	+39%
Muhlenberg	TVA-Paradise	127,451	97,787	105,119	-17%
Ohio	Big Rivers-Wilson**	N/A	6,355	7,832	+23%*
Daviess	OMU**	14,855	10,871	11,056	-25%
Hancock	Big Rivers-Coleman**	23,790	14,696	9,631	-59%
Henderson	Henderson Mun. Power	292	160	241	-17%
Webster	Big Rivers-Reid**	10,736	9,839	8,382	-22%
Webster	Big Rivers-Green**	5,940	8,292	6,708	+13%
Boone	Cincinnati Gas**	N/A	11,442	7,369	-35%*
Carroll	KY Utilities-Ghent**	20,226	22,980	25,895	+28%
Bell	KY Utilities-Pineville	216	204	489	+126%
Clark	E. KY Rural Elec-Dale	1,692	2,481	4,243	+151%
Fayette	KY Utilities-Haefling	28	26	1	-96%
Mercer	KY Utilities-Brown**	12,046	11,319	5,310	-56%
Woodford	KY Utilities-Tyrone	449	518	678	+51%
Lawrence	Am. Elec. Power-Big Sandy	N/A	25,249	24,000***	-5%*
Mason	E. KY Power-Spurlock**	N/A	12,090	16,237	+16%
Pulaski	E. KY Power-Cooper**	3,177	6,594	7,507	+136%
Jefferson	LG&E-Mill Creek**	16,391	19,475	22,899	+39%
Jefferson	LG&E-Cane Run**	14,333	8,674	8,911	-38%
Trimble	LG&E-Trimble**	N/A	2,166	11,450	+428%*
Total	**22**	**286,560**	**300,729**	**324,333**	**+16%**

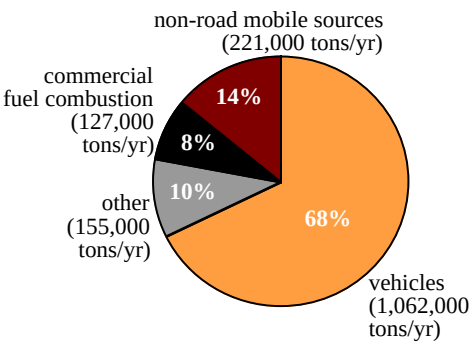
*1995 data preliminary. *1985-95 comparison. **Low NO_x burners used. TVA Shawnee installed fluidized bed combustion on 1 unit which also reduces NO_x emissions. ***Data revised by Am. Elec. Power. Source: Div. Air Quality, Jeff. Co. Air Poll. Control Dist., Utility Information Exchange*

In Kentucky, nitrogen oxide emissions from power plants increased 16% between the years 1980 and 1995. According to U.S. EPA officials, the lack of NO_x reductions may be attributed to the delay in issuing final federal regulations governing NO_x emissions.

Carbon Monoxide Air Levels Decline Significantly

Carbon monoxide (CO) is formed when the carbon in fuels is not burned completely. In the bloodstream it reduces oxygen delivered to tissues and organs producing visual impairment, dizziness, headaches, and impaired coordination. Vehicle exhaust contributed 68% of the carbon monoxide emissions in Kentucky during 1994. Other sources include industrial processes and fuel combustion in boilers and incinerators. In 1994, these sources emitted

CO Emissions in KY[9]

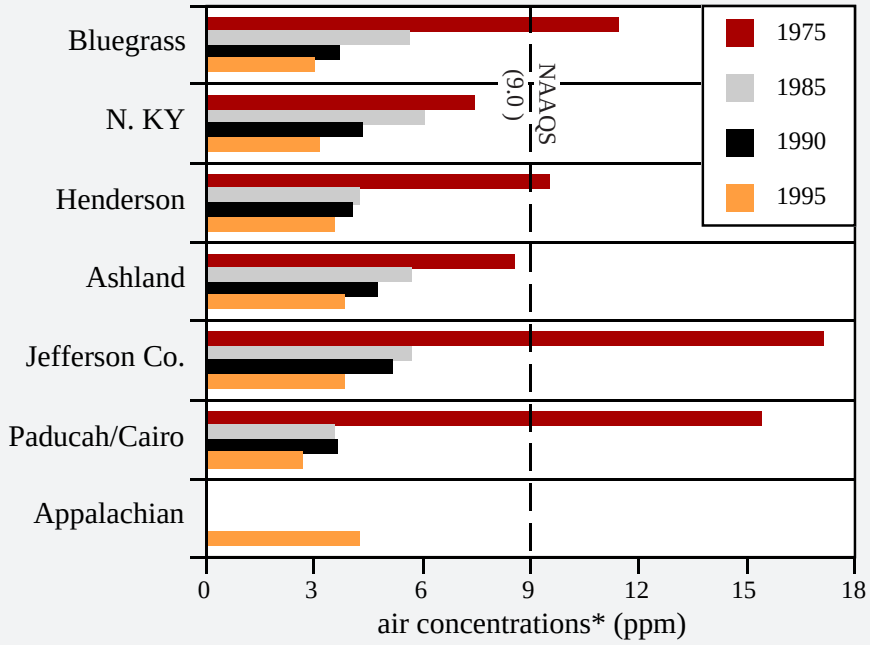


1.56 million tons of CO, ranking Kentucky 26th in the nation for CO emissions.

Statewide and regional carbon monoxide levels in the air show declining trends, primarily due to pollution controls on automobiles **(Figure 3 & 11)**. Despite an overall downward trend in national and statewide carbon monoxide air concentrations and emissions, metropolitan areas still, on occasion, have high episodes of CO. In Kentucky, Louisville experienced a few exceedances of the carbon monoxide standard in 1990 and again in 1993.

Statewide and regional carbon monoxide levels in the air show declining trends, primarily due to pollution controls on automobiles.

Figure 11 Regional Air Concentrations of Carbon Monoxide



*Note: Selected years. *Yearly concentrations based on second maximum eight-hour averages of CO at state monitored sites. Concentrations compared to the National Ambient Air Quality Standard (NAAQS). ppm-parts per million Source: KY Division for Air Quality*

Percent Change in Carbon Monoxide Air Concentrations

Bluegrass	-40%
N. KY	-33%
Henderson	-26%
Ashland	-42%
Jefferson	-56%
Paducah	-54%

Based on 10-year average air concentrations comparing 1976-85 and 1986-95.

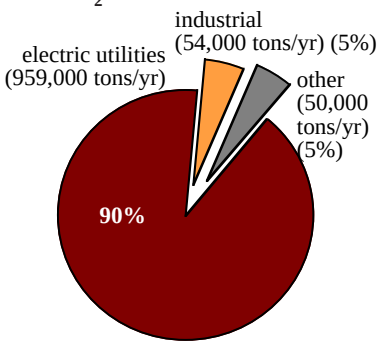
Sulfur Dioxide Air Concentrations Decline 29% During Past 20 Years

Sulfur dioxide (SO_2) is formed when fuel containing sulfur is burned. In 1994, Kentucky ranked among states as the seventh-largest generator of SO_2 emissions.[10] Coal-fired power plants produced 90% of the sulfur dioxide emissions during 1994.

Health concerns related to SO_2 include respiratory illness and aggravation of existing cardiovascular disease. Certain populations are particularly sensitive to SO_2 including children, the elderly, asthmatics, and individuals with chronic lung disease. SO_2 can also damage the foliage of trees and agricultural crops and is a major precursor to acid rain.

Kentucky ranked among states as the seventh-largest generator of SO_2 emissions.[10] Coal-fired power plants produced 90% of the sulfur dioxide emissions during 1994.

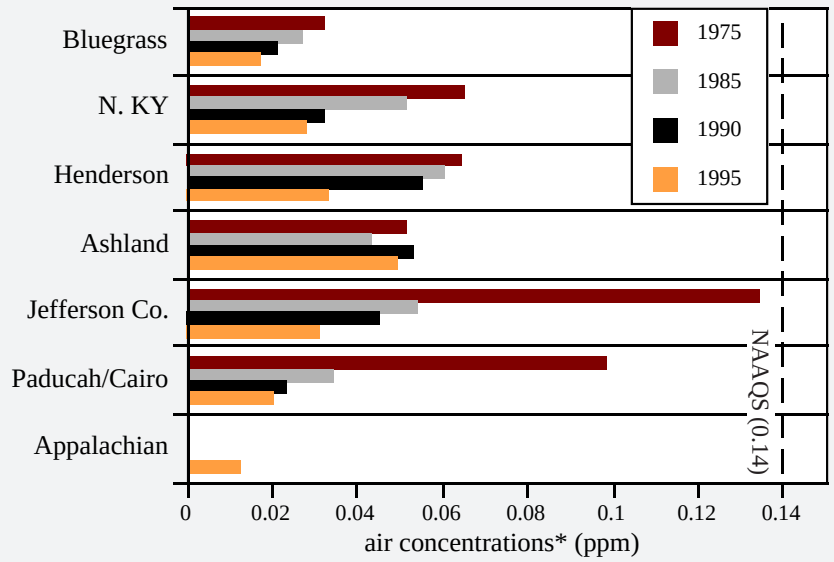
SO_2 Emissions in KY[11]



Statewide air concentrations of sulfur dioxide have declined 29% during the past two decades **(Figure 3)**. Regional air concentrations vary, with the Ashland region having the highest levels in 1995 **(Figure 12)**. Sulfur dioxide emissions in the Ashland region increased 10%, from 104,128 tons in 1985 to 115,075 tons in 1995, possibly contributing to the higher air levels. This region has several large sources of SO_2 including Ashland Oil, AK Steel, E.I. DuPont, American Electric Power, and East Kentucky Power. But air concentrations in the Ashland region and other regions of the state continue to remain below the national SO_2 standard.

Ongoing efforts by power plants to curb SO_2 emissions have likely contributed

Figure 12 Regional Air Concentrations of Sulfur Dioxide



*Note: Selected years. *Yearly concentrations based on second maximum 24-hour averages of SO_2 at state monitored sites. Concentrations compared to the National Ambient Air Quality Standard (NAAQS). ppm-parts per million. Source: KY Division for Air Quality*

Ongoing efforts by power plants to curb sulfur dioxide emissions have likely contributed to declining SO_2 air concentrations in most regions of the state.

Percent Change in Sulfur Dioxide Air Concentrations

Bluegrass	-6%
N. KY	-39%
Henderson	-24%
Ashland	+12%
Jefferson	-50%
Paducah	-38%

Based on 10-year average air concentrations comparing 1976-85 and 1986-95.

to declining air concentrations in most regions **(Figure 13)**. Total SO_2 emissions from power plants in Kentucky fell 41% between 1980 and 1995 while the amount of coal burned at these plants increased 11%, from 32.2 million tons in 1980 to 35.7 million tons in 1995. Nationwide, SO_2 emissions from power plants declined from 25.9 million tons in 1980 to 18 million tons in 1995, according to the U.S. EPA.

Figure 13 Sulfur Dioxide Emissions from Power Plants in KY

County	Facility	1976 tons	1980 tons	1995 tons	1980-95 % change
McCracken	TVA-Shawnee*	288,000	86,961	57,189	-34%
Muhlenberg	KY Utilities-Green River*	27,000	13,529	18,039	+33%
Muhlenberg	TVA-Paradise*	456,000	372,654	172,109	-54%
Ohio	Big Rivers-Wilson	NA	NA	8,131	-
Daviess	OMU*	74,000	45,159	2,390	-94%
Hancock	Big Rivers-Coleman*	100,000	78,650	51,302	-35%
Henderson	Henderson Mun. Power*	9,000	1,526	1,802	+18%
Webster	Big Rivers-Reid	81,000	53,443	16,240	-70%
Webster	Big Rivers-Green	NA	7,618	3,231	-58%
Boone	Cincinnati Gas	NA	NA	10,969	-
Carroll	KY Utilities-Ghent*	76,000	84,553	53,637	-36%
Bell	KY Utilities-Pineville	1,000	467	882	+88%
Clark	E. KY Rural Elec-Dale	8,000	3,929	6,702	+70%
Fayette	KY Utilities-Haefling	5	5	1	-80%
Mercer	KY Utilities-Brown*	57,000	53,153	26,336	-50%
Woodford	KY Utilities-Tyrone	2,000	1,081	1,184	+9%
Lawrence	Am. Elec. Power Big Sandy	60,000	61,617	70,251	+14%
Mason	E. KY Power-Spurlock*	NA	19,322	32,256	+67%
Pulaski	E. KY Power-Cooper*	35,000	12,743	18,125	+42%
Jefferson	LG&E-Mill Creek	112,039	107,491	36,889	-66%
Jefferson	LG&E-Cane Run	109,578	32,904	6,996	-79%
Trimble	LG&E-Trimble	NA	NA	13,489	-
Total	**22**	**1,495,622**	**1,036,805**	**608,150**	**-41%**

*1995 data preliminary. *Utilities affected under Phase I of the National Acid Rain Reduction Program. NA-not operating. Source: KY Division for Air Quality, Jefferson County Air Pollution Control District, U.S. EPA, LG&E*

Total sulfur dioxide emissions from power plants in Kentucky fell 41% between 1980 and 1995 while the amount of coal burned at these plants increased 11%, from 32.2 million tons in 1980 to 35.7 million tons in 1995. Nationwide, SO_2 emissions from power plants declined from 25.9 million tons in 1980 to 18 million tons in 1995, according to the U.S. EPA.

Clean Air Act Calls for Additional SO_2 Emission Reductions

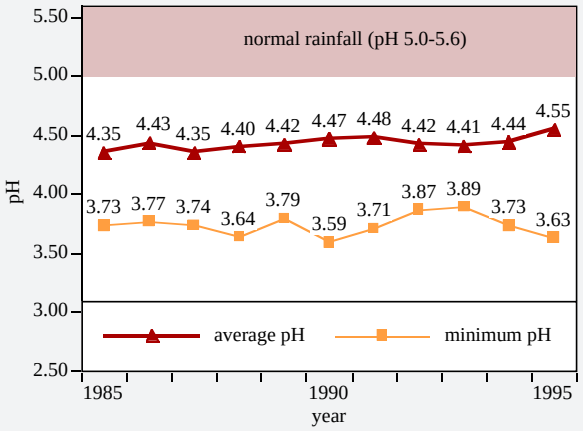
Seventeen units at 10 power plants in Kentucky are affected by the first phase of sulfur dioxide reductions required under the Clean Air Act Amendments of 1990. One power plant, Owensboro Municipal Utilities, recently installed scrubbers reducing SO_2 emissions 94% below 1980 levels.

The Clean Air Act Amendments of 1990 focused additional attention on reducing the threat of acid rain. Sulfur dioxide and nitrogen oxides are the two primary pollutants linked to the formation of acid rain. Acid rain has caused acidification of waterways and can impact trees, crops, and buildings. The Clean Air Act Amendments of 1990 set a cap on SO_2 emissions that can be emitted by large sources such as power plants — about 40% of the amount released in 1980. Power plants have options for reducing emissions by burning cleaner low-sulfur fuel, installing pollution control equipment, or buying unursed SO_2 allowances from other facilities. The first phase of reductions was required by 1995, with a second round in 2000.

Seventeen units at 10 power plants in Kentucky were affected by the first phase of SO_2 reductions **(Figure 13)**. These utilities are using various methods to achieve compliance with the act. Six plants have reduced emissions through technological controls such as scrubbers or clean coal technology with the remainder switching to lower sulfur coal and obtaining additional SO_2 allowances.[12] One power plant, Owensboro Municipal Utilities, recently installed scrubbers, reducing SO_2 emissions 94% below 1980 levels. About 47% of the 35.7 million tons of coal burned by power plants in the state during 1995 was scrubbed to remove SO_2. Measures to reduce SO_2 emissions have likely led to improvements in the pH of Kentucky's rainfall. **Figure 14** shows that since 1985, rainfall has become generally less acidic.

Measures to reduce sulfur dioxide emissions have likely led to improvements in the pH of Kentucky's rainfall. Figure 14 shows that since 1985, rainfall has become generally less acidic.

Figure 14 Average pH of Rainfall at Monitored Sites in KY

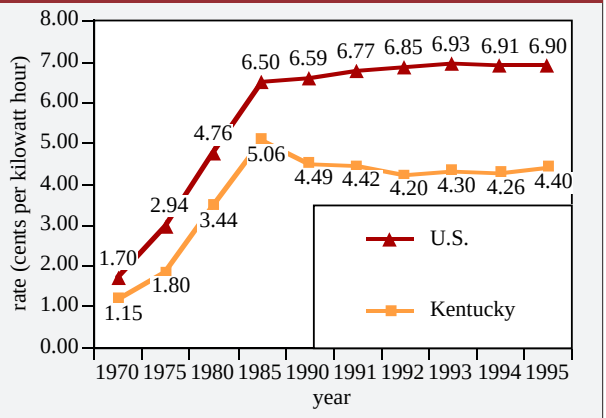


Note: Volume-weighted averages from monitored sites in Washington, Letcher, Rowan, and Trigg counties. pH is a measure of acidity or alkalinity of a solution. Source: National Precipitation Program, Illinois Water Survey

Despite the costs of complying with environmental rules, utility rates in Kentucky have remained below the national average **(Figure 15)**. A state law passed in 1992 now allows utilities to assess an environmental surcharge to recover costs of compliance with the Clean Air Act Amendments of 1990. Three companies in Kentucky currently impose surcharges as part of the utility bill. Kentucky Utilities collected $17.9 million in surcharges during 1995 to cover costs of 15 projects. Louisville Gas and Electric collected $2.7 million in 1995 from its environmental surcharges to fund five

Despite the costs of bringing power plants into compliance with environmental requirements, utility rates in Kentucky have remained below the national average. A state law passed in 1992 now allows utilities to assess an environmental surcharge to recover costs of compliance with the Clean Air Act Amendments of 1990. Three companies in Kentucky currently impose surcharges as part of the utility bill.

Figure 15 Average Electric Rates in KY and United States



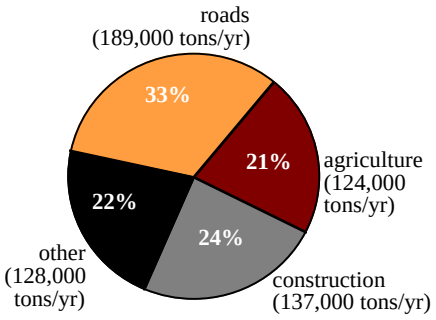
Note: Rates estimated based on monthly data. Data not adjusted for inflation. Source: U.S. DOE, State Energy Price and Expenditure Reports, 1970-95

projects. Big Rivers Electric Corp. collected $1.6 million in surcharges during 1995 to recover environmental compliance investments.[13] The surcharges were challenged by the KY Attorney General and others in January 1994 based on constitutional issues and how compliance costs were determined. The Franklin Circuit Court ruled in July 1995 that the surcharges are legal. The state is appealing the decision.

Levels of Airborne Particulates Decline 18% During Past Eight Years

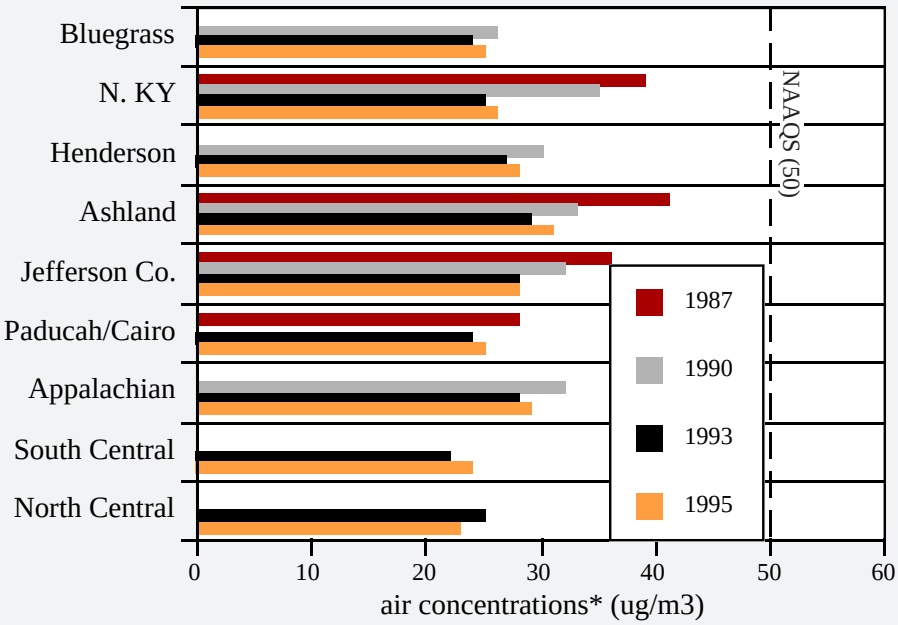
Particulates are small particles of dust, dirt, and soot emitted by sources such as cars, construction projects, agricultural operations, and roads. In 1994, 579,000 tons of particulate emissions were released from these and other sources. Kentucky ranks 33rd in the nation in particulate emissions. Health concerns from exposure to particles in the air (those 10 micrometers or less, known as PM-10) include effects on breathing and respiratory systems, cancer, and premature death. The elderly, children, and people with chronic lung disease are especially sensitive to particulate matter.

Particulate (PM-10) Sources in KY[14]



Air monitors began measuring particulates based on the PM-10 standard in 1987. Between 1987 and 1995, the average statewide PM-10 air concentrations declined 18%, as seen in **Figure 3**. All regions of the state remain well below the national PM-10 standard **(Figure 16)**.

Figure 16 Regional Air Concentrations of Particulates (PM-10)



*Note: Selected years. *Yearly concentrations based on PM-10 averages at state monitored sites. Concentrations are compared to the National Ambient Air Quality Standard (NAAQS). *ug/m3-micrograms per cubic meter. Source: KY Division for Air Quality*

Particulates are small particles of dust, dirt, and soot emitted by sources such as cars, construction projects, agricultural operations, and roads. All regions of the state currently meet the national PM-10 standard.

Percent Change in Particulate Air Concentrations

Bluegrass	-7%
N. KY	-30%
Henderson	-10%
Ashland	-12%
Jefferson	-15%
Paducah	-14%
Appalachian	-17%

Based on four-year average air concentrations comparing 1988-91 and 1992-95.

Health Concerns May Lead to More Stringent Particulate Standard

Recent studies indicate that small particles in the air may pose a more serious threat to health at levels well below the current PM-10 standard. A 1996 study by the Natural Resources Defense Council (NRDC) estimates 64,000 people die prematurely in the U.S. from cardiopulmonary causes linked to particulate air pollution.[15] However, the National Mining Association and others have questioned the findings of the NRDC report citing they were based on poor science.[16] The U.S.

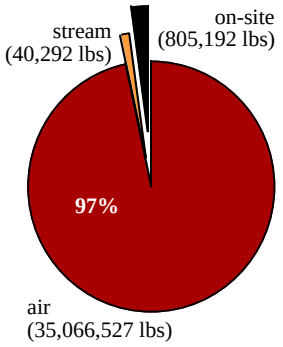
EPA is evaluating health studies to determine the need for a more stringent particulate standard. The new standard under consideration would limit emissions of fine particles of 2.5 micrometers or less and be more protective of public health.[17]

Reported Air Releases of Toxic Chemicals Decline 25% in Five Years

Toxic air pollutants are those chemicals known to cause or suspected of causing cancer or other health effects such as birth defects or reproductive problems.

The major source of data on toxic emissions is the Toxic Chemical Release Inventory (TRI). TRI is a mechanism created under federal law that requires certain manufacturing plants to report releases and transfers of toxic chemicals. Although the TRI presents the best available data on the generation of toxic chemicals, it has its limitations. TRI does not include small industrial and nonindustrial sources of toxic emissions. The TRI data is also based on calculated estimates, is not independently verifiable, and many toxic chemicals are not included in the TRI inventory. TRI reduction trends are also difficult to measure due to the addition of new reportable chemicals each year. For example, in 1995, TRI will have an additional 241 chemicals added to the list of reportable chemicals.

Toxic Releases in KY[18]



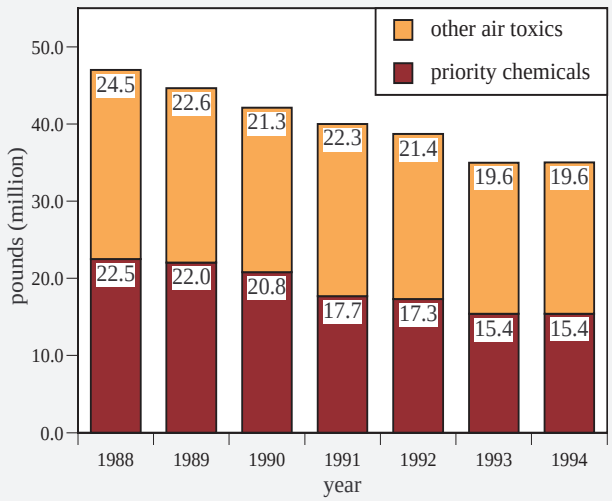
During 1994, the most recent year for which data is available, 424 industries reported releasing 36.2 million pounds of toxic chemicals to the environment, 97% of which was to the air.

During 1994, the most recent year for which TRI data is available, 424 industries in Kentucky reported releasing 36.2 million pounds of toxic chemicals to the environment, 97% of which was to the air. But data also reveal that statewide releases of air toxics have declined 25% between 1988 and 1994 **(Figure 17)**. Air releases of 17 toxic chemicals in Kentucky prioritized by the U.S. EPA for reduction because they are considered highly toxic, carcinogenic, or released in large volumes have declined 31% since 1988. A majority of the toxic air emissions occur in ten counties. These counties accounted for 75% of the toxic air emissions reported released to the air in 1994 **(Figure 18)**.

Air releases of 17 toxic chemicals in Kentucky prioritized by the U.S. EPA for reduction because they are considered highly toxic, carcinogenic, or released in large volumes have declined 31% since 1988.

The top ten industries releasing toxic air emissions in 1994 emitted 18.9 million pounds, 54% of the state release total **(Figure 19)**. DuPont, the top emitter, reported that toxic air releases tripled between 1993 and 1994 due to the reporting of Freon 22, a new chemical added to the TRI list in 1994. This was also the case for the increase at Elf Atochem with the reporting of two new ozone-depleting chemicals added to the TRI list in 1994. A number of companies have made progress in voluntarily reducing toxic emissions. The Clean Air Act Amendments of 1990 focus additional attention on reducing toxic air

Figure 17 Toxic Air Releases From Manufacturing Plants in KY



Note: Includes new chemicals added to the reportable list in recent years. Priority chemicals are 17 toxic chemicals prioritized for reduction by the U.S. EPA.
Source: Toxic Release Inventory Reports, 1988-94

emissions and will require technology-based standards on major emitters of 189 hazardous air pollutants by the year 2000.

Kentucky promulgated its own air toxic regulations in 1986. The effectiveness as well as the efficiency of the state air toxics regulations, however, have been questioned by both the environmental and regulated community. The Division for Air Quality is currently reviewing options to improve the air toxics regulations and will develop a proposal in the next several months, according to agency officials.

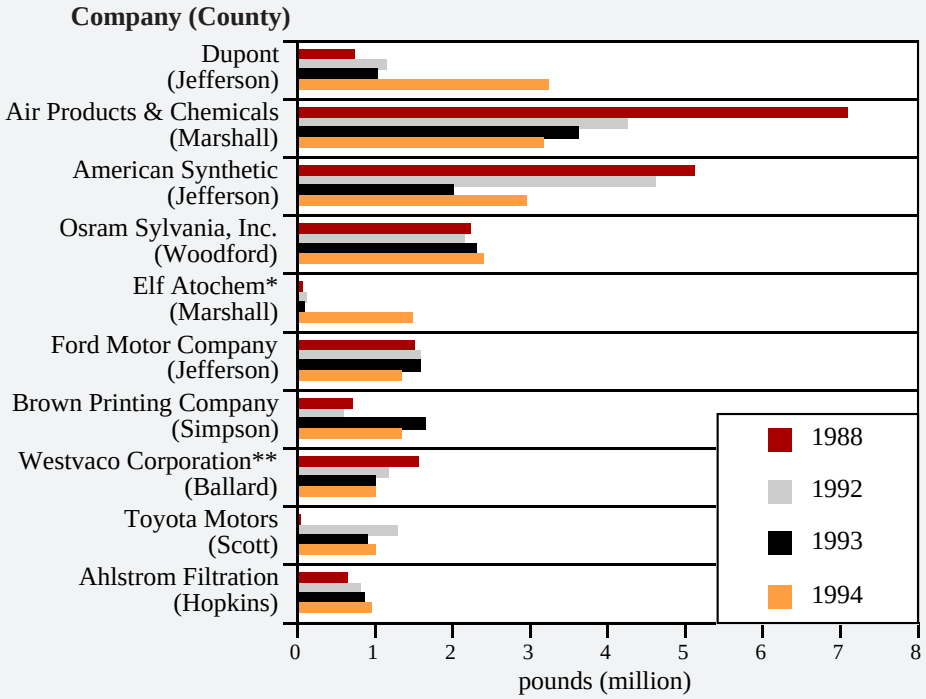
Figure 18 Top Ten Counties with Toxic Air Releases (1994)

County	1988 pounds	1993 pounds	1994 pounds	1988-94 % change	1993-94 % change
Jefferson	11,924,548	8,684,842	10,446,219	-12%	+20%
Marshall	9,921,245	4,125,941	5,099,701	-49%	+23%
Woodford	2,350,511	2,336,791	2,426,768	+3%	+4%
Hancock	3,750,587	2,075,836	1,535,112	-59%	-26%
Simpson	904,170	1,809,724	1,531,000	+69%	-15%
Logan	1,829,826	1,343,909	1,346,436	-26%	+<1%
Ballard	806,350	1,039,980	1,062,155	+32%	+2%
Scott	37,016	1,065,822	1,042,713	+2716%*	-2%
Hopkins	1,029,069	903,525	985,242	-4%	+9%
Madison	821,367	1,178,185	975,244	+19%	-17%
Total	**33,374,689**	**24,564,555**	**26,450,590**	**-21%**	**+8%**
State Total	47,023,709	35,016,322	35,066,527	-25%	+.14%

*Note: Includes new chemicals added to the reportable list in recent years. *Attributed to the location of Toyota Motor Manufacturing U.S.A. in Scott County.*
Source: Toxic Release Inventory Reports, 1988-94.

A majority of the toxic air emissions occur in ten counties. These counties accounted for 75% of the toxic air emissions reported released to the air in 1994.

Figure 19 Top 10 Facilities with Toxic Air Releases in KY (1994)



*Note: Includes new chemicals added to the reportable list in recent years. *Company name in 1988 was Pennwalt. **Data includes revisions to TRI data.*
Source: Toxic Release Inventory Reports, 1988-94.

The top ten industries releasing toxic air emissions in 1994 emitted 18.9 million pounds, 54% of the statewide release total. The Clean Air Act Amendments of 1990 focus additional attention on reducing toxic air emissions and will require technology-based standards on major emitters of 189 hazardous air pollutants by the year 2000.

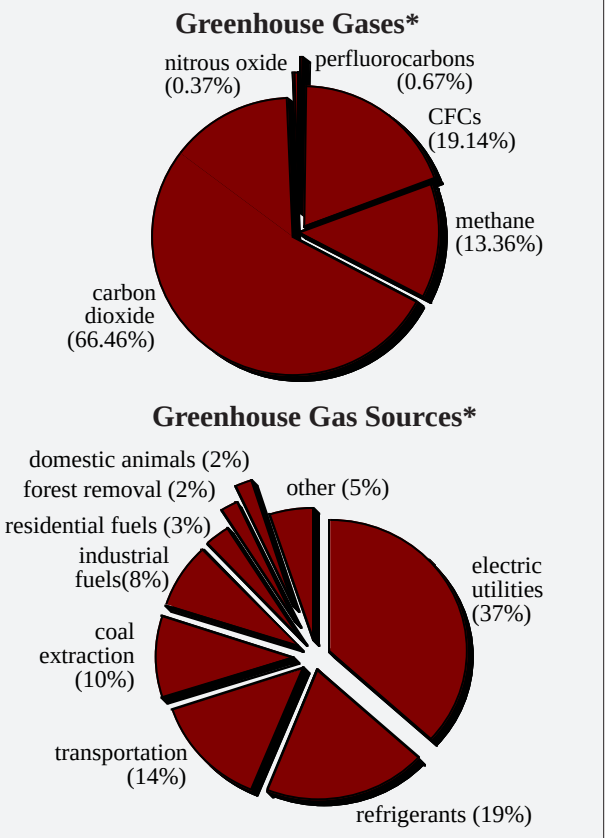
Greenhouse Gases Inventoried in Kentucky

Although scientific uncertainties remain concerning the potential effects of greenhouse gases on global climates, policy makers at the international level agreed to control these gases and enacted a global climate treaty to stabilize greenhouse gas emissions at 1990 levels by the year 2000.

Many scientists believe that global temperatures are rising due to increased amounts of greenhouse gases in the atmosphere. However, others believe that it is impossible to distinguish any global temperature changes because of short-term variations in temperature and long-term weather patterns.

The primary greenhouse gases linked to global warming are carbon dioxide, chlorofluorocarbons (CFCs that include Freon and related compounds used as refrigerants), methane, perfluorocarbons, and nitrous oxides. These gases warm the Earth by trapping the sun's heat in the lower atmosphere. All of these gases are naturally occurring, except for CFCs. However, since the industrial revolution, human activities have increased atmospheric concentrations of nitrous oxides by 13%, carbon dioxide by 29%, methane by 300%, CFC-11 by 268%, and CFC-12 by 503%.[19]

Figure 20 Greenhouse Gases in KY



*Note: Based on 205 million tons of greenhouse gas emissions calculated released in 1990. *Based on carbon dioxide equivalent tons. Source: KY Greenhouse Gas Inventory, 1996*

A 1996 study, conducted by the University of Louisville Institute for the Environment and Sustainable Development, found that power plants and the production and use of refrigerants are the greatest sources of greenhouse gases in Kentucky. It was estimated that in 1990, 205 million tons of greenhouse gas emissions were released to the atmosphere from Kentucky sources.

Although scientific uncertainties remain concerning the potential effects of greenhouse gases on global climates, policy makers at the international level agreed to control these gases and enacted a global climate treaty to stabilize greenhouse gas emissions at 1990 levels by the year 2000. To help formulate a plan to meet this goal, the EPA commissioned studies to inventory greenhouse gases in the U.S.

A 1996 study, conducted by the University of Louisville Institute for the Environment and Sustainable Development, found that power plants and the production and use of refrigerants are the greatest sources of greenhouse gases in Kentucky. It was estimated that in 1990, 205 million tons of greenhouse gas emissions were released to the atmosphere from Kentucky sources **(Figure 20)**.

Twenty-six companies in the state reported releasing 5.6 million pounds of CFCs to the air in 1994, ranking Kentucky second in the nation in emissions of ozone-depleting chemicals.

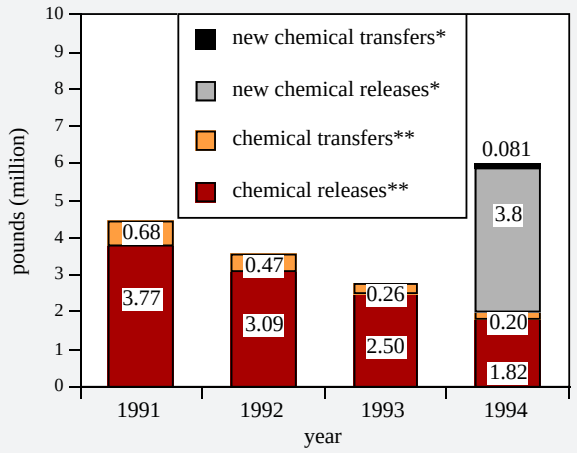
State Ranked Second in Emissions of Ozone Depleting Chemicals

The loss of the protective ozone layer is also believed to be contributing to global warming by allowing more of the sun's rays to pass through the Earth's atmosphere and warm the planet. The ozone layer surrounds the Earth and shields out ultraviolet radiation. Depletion of the stratospheric ozone has been linked to increased levels of ultraviolet-B radiation (UV-B). Excessive exposure to UV-B can lead to a greater incidence of sunburn and skin cancer and may also reduce crop yields and disrupt natural food chains.

The thinning of the ozone layer is related to both natural and human factors. The manufacture and release of ozone-depleting chemicals, namely chlorofluorocarbons, hydrochlorofluorocarbons, carbon tetrachloride, methyl bromide, methyl chloroform, and halons, have been linked to the thinning of the ozone layer. In 1988, 140 countries created a treaty, known as the Montreal Protocol. The treaty, which was amended in 1990 and 1992, stipulates sharp reductions in ozone-depleting chemicals by 1996. The U.S. EPA, under the authority of the Clean Air Act Amendments of 1990, issued regulations to phase out the production and importation of ozone-depleting chemicals controlled under the Protocol.

Data from TRI reports reveal that 26 companies in the state reported releasing 5.6 million pounds of CFCs to the air in 1994, ranking Kentucky second in the nation in emissions of ozone-depleting chemicals. Ten of these companies accounted for 93% of the total releases. Trends reveal, however, that releases of some CFC chemicals have declined. For example, emissions of Freon 113 declined 98% in the state from 2.6 million pounds in 1988 to 38,668 pounds in 1994. Releases of 11 ozone-depleting chemicals fell 52% between 1991 and 1994 in Kentucky **(Figure 21)**.

Figure 21 Generation of Ozone-Depleting Chemicals from Industries in KY



*Note: Chemical transfers are those chemicals transferred for treatment or recycling. *Chemical releases and transfers of four new chemicals required to be reported in 1994. **Based on 11 ozone-depleting chemicals reported generated in KY. Source: Toxic Release Inventory Reports, 1988-94*

Top 10 Companies Releasing Ozone-Depleting Chemicals to the Air in Kentucky (1994)

Company (County)	Pounds
DuPont (Jefferson)	2,298,386
Elf Atochem (Marshall)	1,440,945
GE Appliances (Jefferson)	533,812
U.S. Enrichment (McCracken)	361,000
Olin Corp. (Meade)	204,130
Okonite Co. (Madison)	135,700
Carpenter Co. (Logan)	84,977
Firestone Bldg (Kenton)	82,320
Prem. All. Tool (Daviess)	72,187
Topy Corp. (Franklin)	55,000
Total Top 10	**5,268,457**
Total State	**5,661,749**

Includes four new chemicals reported in 1994. Source: Toxic Release Inventory Report, 1994

Improvements in Air Quality Due to Programs to Control Pollutants

The improvement in air quality is due to various federal, state, and local regulatory measures as well as investments by both large and small sources to control air pollution. The KY Division for Air Quality is the principal agency responsible for monitoring and implementing clean air regulations in Kentucky. In addition, Jefferson County created its own Air Pollution Control District in 1952 and was approved by the U.S. EPA in 1970 to implement the provisions of the Clean Air Act for the county and metropolitan Louisville.

A major tool to address air pollution from industrial sources are permits. The Division for Air Quality currently regulates 2,082 industrial and commercial sources of air pollution through permits. The Jefferson County Air Pollution Control District regulates 1,587 sources; about half, 776, are gas stations. Air quality permits specify construction and operating requirements and set limits on air pollutant emissions. During 1995, more than 5,000 inspections were conducted in Kentucky at permitted facilities to ensure compliance with air quality permits and regulations.

In 1995, 918 violations of air quality rules were cited by the KY Division for Air Quality (297 at permitted facilities, 43 at area sources, 158 for asbestos violations, 368 for open burning, 43 for dust, 1 for odor, and 8 at tank sources.) Of the 2,082 permitted sources regulated by the Division for Air Quality, 10% (217) were in violation of air quality rules in 1995. The Jefferson County Air Pollution Control District issued 71 notice of violations in 1995 (32 at permitted facilities and 39 for

A major tool to address air pollution from industrial sources are permits. The Division for Air Quality currently regulates 2,082 industrial and commercial sources of air pollution through permits. The Jefferson County Air Pollution Control District regulates 1,587 sources.

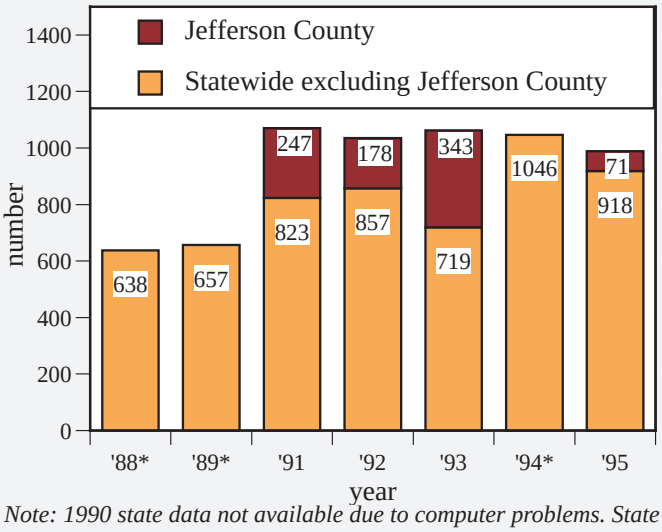
In 1995, 918 violations of air quality rules were cited by the KY Division for Air Quality, 40% of which were for open burning. The Jefferson County Air Pollution Control District issued 71 notice of violations in 1995. While most violations are resolved through demand letters or agreed orders, some result in penalties.

Air Quality Penalties

Year	$State	$Jeff. Co.*
1990	126,500	N/A
1991	1,698,375	N/A
1992	N/A	282,000
1993	847,425	377,000
1994	366,650	N/A
1995	876,450	80,000

*N/A-Data not available. *Federal fiscal year. Source: KY Division for Air Quality, KY Division of Administrative Hearings, Jefferson County Air Pollution Control District*

Figure 22 Air Quality Violations Cited in KY



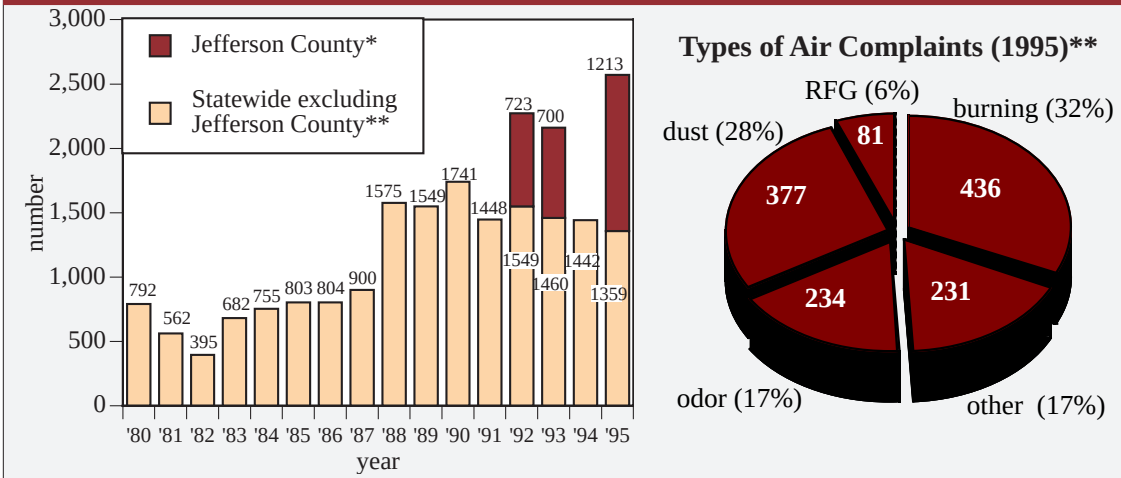
*Note: 1990 state data not available due to computer problems. State data refined from 1992 & 1994 State of Environment Reports. *Data not available for Jefferson County. Source: KY Division for Air Quality, Jefferson County Air Pollution Control District*

opening burning, asbestos, and other) **(Figure 22)**. While many violations are resolved through demand letters or agreed orders, some result in penalties. In 1995, $876,450 in penalties were assessed by the Division for Air Quality to 116 permitted facilities, 18 individuals, 8 public facilities, 2 federal facilities, and 1 state government agency. In Jefferson County, $80,000 in fines were assessed by the district against 217 parties in fiscal year 1995. The district reports that most penalties were small but a few were significant.

The Division for Air Quality has also worked to resolve violations through mechanisms known as supplemental enforcement projects (SEPs). During 1995, 10 SEPs were used to mitigate $885,000 in penalties. These projects ranged from television announcements to advise the public about open burning laws to an agreement by one company to study and potentially install a hydrogen fluoride mitigation system.

Many violations are the result of complaints received by regulatory agencies. In 1995, more than 2,500 complaints were received by air quality officials **(Figure 23)**. Many complaints concern open burning, dust, and odor. However, in 1995, state officials received 81 complaints regarding the use of RFG gasoline, which went on sale in 1995 in Jefferson County and Northern Kentucky to help control ozone pollution. The fuel has been criticized for poor vehicle performance and health concerns. While these problems are largely unsubstantiated, RFG does cost slightly more than conventional gasoline, which has also been among the complaints.

Figure 23 Air Quality Citizen Complaints in KY - Number and Type



*Jefferson County data not available for all years. **Complaints received by the KY Division for Air Quality. Source: KY Division for Air Quality, Jefferson County Air Pollution Control District*

Large Air Pollution Sources Must Apply for New Permits in 1996

The Clean Air Act Amendments of 1990 also created a new air quality permitting program. The requirements are mandated in Title V of the amendments. Approximately 955 sources in Kentucky will be affected by the Title V program.

All major air pollution sources are required to submit applications for new Title V permits by December 14, 1996. Approximately 955 sources in Kentucky will be affected by the Title V program.

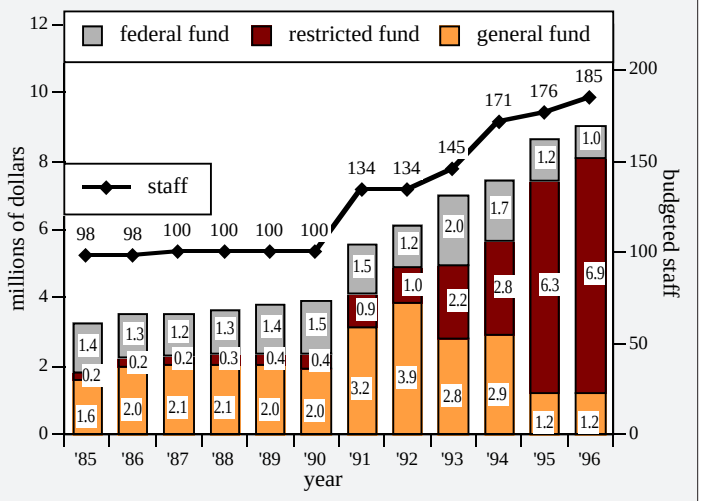
The Title V program is designed to improve the permitting process by providing national conformity in the permitting process, guaranteeing that permits address all applicable Clean Air Act requirements, and requiring sources to demonstrate how they will comply with those requirements. Title V provides additional opportunities for public review and comment on air quality permits as well.

The Division for Air Quality was granted interim approval by the U.S. EPA to implement the Title V program, effective December 14, 1995. All major air pollution sources are required to submit Title V permit applications by December 14, 1996. Major sources are defined as those that have the potential to emit 10 tons per year of a hazardous pollutant, 25 tons per year or more of a combination of hazardous pollutants, or 100 tons per year or more of any other regulated air pollutant. The Division is required to issue Title V permits to 60% of the major sources by December 14, 1998, with the remainder issued by the year 2000.

The Title V permit program will be funded by fees charged to air pollution sources based on actual air emissions. In fiscal year 1995, $5.5 million in emission fees were collected by the Division for Air Quality from 963 sources to fund the new Title V permit program. This amounted to an emission fee of $34.35 per ton. The fees, which were phased in beginning in 1992, will cover the costs of issuing the Title V permits. The fees accounted for 63% of the division's $8.7 million budget in 1995 **(Figure 24)**. Jefferson County collected $1.2 million in emission fees from 48 sources during 1995.

In fiscal year 1995, $5.5 million in emission fees were collected by the Division for Air Quality from 963 sources to fund the new Title V permit program. These fees accounted for 63% of the division's $8.7 million budget in 1995.

Figure 24 KY Division for Air Quality Budget and Staff Trends



Note: Based on fiscal year. Not adjusted for inflation. General funds are state appropriated money. Federal funds are federal program grants. Restricted funds are funds collected through permit fees and other sources. Source: Budget Office, KY Natural Resources and Environmental Protection Cabinet

Minor air pollution sources must also obtain Title V permits but the U.S. EPA has deferred this until the year 2000. In the meantime, Kentucky has established a program to assist small businesses comply with air quality rules. The KY Business Environmental Assistance Program (KBEAP) began operations in 1994. Its staff of three has provided assistance to 80 businesses to date. KBEAP, located at the University of KY, has an annual operating budget of $250,000, which is provided through emission fees collected by the state. KBEAP has also conducted 35 workshops on permitting and other topics. The KY Natural Resource and Environmental Protection Cabinet also created an Ombuds Office to assist small businesses comply with air quality rules and an Advisory Panel to help assess the small business assistance program. Jefferson County has also established similar small business programs.

Minor air pollution sources must also obtain Title V permits but the U.S. EPA has deferred this requirement until the year 2000. In the meantime, Kentucky has established a program to assist small businesses comply with air quality rules.

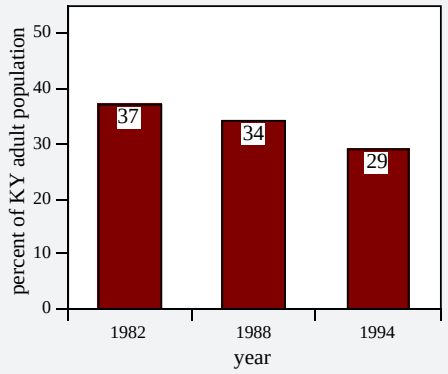
Indoor Air Pollution Ranked a High Health Risk in Kentucky

Many Americans spend up to 90 percent of their time indoors, often at home. Therefore, indoor air quality can have an important impact on health. A recent assessment by the U.S. EPA ranked indoor air pollution as a leading public health threat in the Southeastern U.S. Most homes have more than one source of indoor air pollution. For example, air pollutants can come from tobacco smoke, building materials, home furnishings, and activities such as cooking, heating, and cleaning.

Exposure to environmental tobacco smoke was ranked as a high health risk, according to a 1995 draft state environmental risk study.[20] National studies indicate that secondhand smoke causes lung cancer in adult nonsmokers and impairs the respiratory health of children.[21] While Kentucky ranks the highest among states for the percentage of adults that smoke, those levels are declining **(Figure 25)**.[22] The Cabinet for Health Services has targeted a reduction of smoking to a level of no more than 23% of the adult population by the year 2000.

In Kentucky, exposure to environmental tobacco smoke was ranked as a high health risk. While Kentucky ranks the highest among states for the percentage of adults that smoke, those levels are declining.[22]

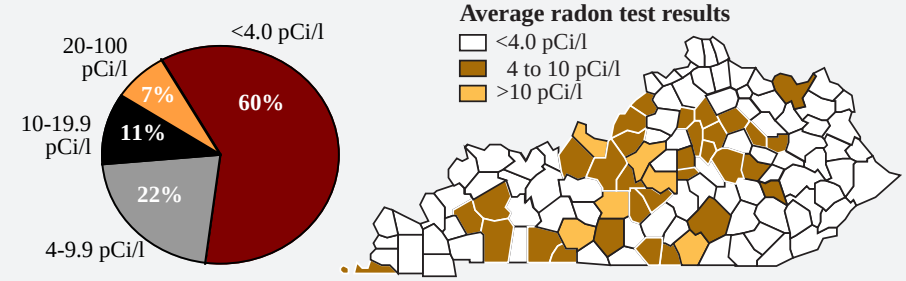
Figure 25 Percent of KY Adult Population Who Smoke Cigarettes



Source: KY Cabinet for Health Services

Another indoor air pollutant that was ranked a high risk in Kentucky is radon. Radon is a colorless, odorless gas that occurs naturally but can enter homes through cracks in foundations. It is estimated that 207 lung cancer cases occur annually in the state due to exposure to radon gas, according to the state risk study. Forty percent of the 24,547 homes tested in Kentucky for radon in the past 10 years by one company exceeded the U.S. EPA health advisory limit of 4.0 pico Curies per liter (pCi/l) **(Figure 26)**.[23] Recent studies have questioned the link between cancer and radon, however, the U.S. EPA has indicated that it does not plan to revise the radon limits at this time.

Figure 26 Indoor Air Radon Levels in Kentucky



Note: Based on 24,547 radon tests conducted from 1986-July 1996. Source: Air Chek Inc.

Forty percent of the 24,547 homes tested in Kentucky for radon in the past 10 years by one company exceeded the U.S. EPA health advisory limit of 4.0 pico Curies per liter (pCi/l).[23]

While sources of indoor air pollution are not regulated, homeowners can take steps to minimize threats. The U.S. EPA recommends limiting exposure, especially for young children, to secondhand tobacco smoke. The Cabinet for Health Services also recommends that homeowners test for radon. Most local health departments provide information about radon testing and steps to take to reduce exposure. Risks of carbon monoxide exposure can be reduced by keeping gas appliances adjusted, using exhaust fans, maintaining heating systems, and installing carbon monoxide detectors. Steps to reduce formaldehyde include increasing ventilation when bringing new sources of formaldehyde, such as drapes, textiles, and glues into the home.

State efforts to minimize public exposure to airborne asbestos fibers, which are known to cause cancer, have been ongoing since 1987. Since the program began, the Jefferson County Air Pollution Control District has issued 4,954 asbestos removal permits, and the Division for Air Quality has overseen 7,901 asbestos removal projects in commercial, institutional, and industrial buildings.

1995 Emissions From Permitted Sources by Air Quality Control Region (emissions reported in tons)

	County	SO_2	NO_x	CO	VOC	PM-10
Paducah-Cairo	Ballard	518	738	7,757	966	203
	Caldwell	8.9	54	15	57	48
	Calloway	4	26	20	194	73
	Carlisle	0	0	0	.3	13
	Christian	685	125	31	1,263	233
	Crittenden	11	1	4	17	16
	Fulton	5	8	1	65	117
	Graves	32	141	27	482	329
	Hickman	0	.4	.1	0	29
	Hopkins	77	54	23	413	492
	Livingston	.6	4	43	4	667
	Lyon	15	29	4	40	74
	McCracken	57,630	36,706	1,790	618	1,036
	Marshall	2,301	2,630	682	10,139	682
	Muhlenberg	190,219	109,169	1,830	278	703
	Todd	22	40	9	14	69
	Trigg	.01	2	.4	82	39
Henderson	Daviess	2,943	11,558	739	3,641	531
	Hancock	57,473	10,388	13,009	1,107	2,647
	Henderson	5,062	463	25,487	710	1,254
	McLean	.2	1	.5	.05	8
	Ohio	8,133	7,846	432	318	149
	Union	.1	10	1	263	246
	Webster	19,476	14,983	671	114	604
Northern KY	Boone	11,044	7,481	609	1,333	310
	Campbell	15	100	76	311	42
	Carroll	53,672	26,217	1,557	682	590
	Gallatin	8	28	17	3	21
	Grant	17	9	2	98	1
	Kenton	3.2	32	8	571	13
	Owen	0	.08	.01	31	.4
	Pendleton	195	1,260	617	36	230
Appalachian	Bell	9,008	504	34	52	223
	Breathitt	.2	12	8	31	125
	Clay	0	.8	.2	11	21
	Floyd	5	47	22	28	67
	Harlan	12	3	310	87	334
	Jackson	5	.5	3	7	7
	Johnson	8	9	5	37	70
	Knott	.06	66	66	99	208
	Knox	.7	6	20	62	66
	Laurel	16	18	121	4,895	155
	Lee	3	.2	.9	61	4
	Leslie	0	0	0	0	159
	Letcher	4	.5	1	20	208
	Magoffin	0	0	0	0	4
	Martin	531	485	28	155	308
	Owsley	0	0	0	0	.06
	Perry	14	23	21	54	282
	Pike	6	6	51	29	2,059
	Rockcastle	3	2	1	6	8
	Whitley	.08	12	9	13	38
	Wolfe	0	0	0	6	.3
Bluegrass	Anderson	71	78	31	1,986	121
	Bourbon	21	11	47	137	73
	Boyle	183	300	81	347	69
	Clark	6,710	4,282	152	100	217
	Estill	4	.3	1	49	163
	Fayette	104	774	170	721	155
	Franklin	152	82	33	15,522	105
Bluegrass continued	Garrard	17	7	13	24	5
	Harrison	1	33	20	607	79
	Jessamine	.3	14	9	705	24
	Lincoln	.3	7	11	92	38
	Madison	102	301	88	624	211
	Mercer	26,357	5,336	330	150	226
	Nicholas	.03	5	1	.2	1
	Powell	3	17	7	1	1,066
	Scott	2	149	69	3,031	219
	Woodford	1,460	1,660	39	2,203	118
Ashland	Bath	0	0	0	0	0
	Boyd	10,483	6,343	6,144	3,834	2,469
	Bracken	0	0	0	0	12
	Carter	7	13	18	30	103
	Fleming	4	.3	1	22	4
	Elliott	0	0	0	0	0
	Greenup	1,936	65	13	140	23
	Lawrence	70,255	31,006	903	116	1,846
	Lewis	0	0	0	0	0
	Mason	32,338	17,595	1,748	118	598
	Menifee	.1	.7	8	.9	28
	Montgomery	.07	9	3	113	48
	Morgan	30	19	319	28	88
	Robertson	0	0	0	0	0
	Rowan	22	53	39	8	28
North Central	Breckinridge	9	458	91	18	39
	Bullitt	345	159	54	2,768	233
	Grayson	13	31	16	133	95
	Hardin	7	191	55	392	718
	Henry	10	9	40	104	30
	Larue	0	0	0	11	2
	Marion	37	250	71	301	258
	Meade	158	833	88	492	86
	Nelson	264	212	64	4,945	39
	Oldham	11	8	5	47	52
	Shelby	.4	57	21	465	88
	Spencer	.7	0	0	0	.06
	Trimble	13,493	11,463	427	67	217
	Washington	3	5	2	22	18
South Central	Adair	13	3	5	22	62
	Allen	.05	10	21	28	23
	Barren	81	141	150	330	272
	Butler	.2	26	5	1	18
	Casey	7	1,065	142	136	12
	Clinton	8	10	6	2	9
	Cumberland	0	0	0	0	4
	Edmonson	0	0	0	0	.02
	Green	14	25	27	58	25
	Hart	5	25	19	185	35
	Logan	54	243	55	212	149
	McCreary	2	1	6	.2	19
	Metcalfe	0	24	2	14	19
	Monroe	3	9	87	10	50
	Pulaski	18,170	7,628	314	1,791	750
	Russell	62	78	27	1	5
	Simpson	1	35	8	1015	92
	Taylor	100	128	195	234	30
	Warren	74	105	40	906	282
	Wayne	5	14	12	14	60
Jefferson County	Jefferson	56,353	36,223	2,700	13,616	4,150

Note: Based on 1995 preliminary data. Source: KY Division for Air Quality, Jefferson County Air Pollution Control District

References

1. Lead air concentrations in Kentucky have declined 97% between 1980 and 1990 primarily due to the phaseout of lead-based gasoline.
2. Lead is only monitored in Woodford and Greenup counties near industrial sources. Levels of lead recorded at these sites are well below the health-based standard.
3. US EPA (1995). Comparison of Preliminary 1995 Ozone Concentrations to 1993 and 1994 (Dec. 1995). A violation of the ozone standard occurs when the standard is exceeded more than three times in a three-year period at the same monitor, based on monitoring and calculated data.
4. American Lung Association (1995). National Health Interview Survey.
5. Kentucky Division for Air Quality (1996). Based on 1990 VOC calculated emissions. Non-highway mobile sources include airplanes, locomotives, heavy equipment, and other vehicles.
6. Inside EPA, Environmental Policy Alert (1996). EPA Eyes Flexible New National Ozone Standard, Vol. XIII, No. 9, April 24, 1996.
7. US EPA (1995). National Air Pollutant Emission Trends 1900-94, p 2.7.
8. US EPA (1996). Acid Rain Program Emissions Scorecard.
9. US EPA (1995). National Air Pollutant Emission Trends 1900-94, p 2.6.
10. US EPA (1995). Emissions Trends Under the Acid Rain Program.
11. US EPA (1995). National Air Pollutant Emission Trends 1900-94, p 2.9.
12. Kentucky Utilities Company (1996). Phase I Units in Kentucky.
13. Kentucky Public Service Commission (1996). Environmental Surcharge Revenues, Total Reported Revenues for Each Authorized Surcharge, Information from Monthly Surcharge Reports.
14. US EPA (1995). National Air Pollutant Emission Trends 1900-94, p2.10.
15. Natural Resources Defense Council (1996). Breath-Taking: Premature Mortality Due to Particulate Air Pollution in 239 American Cities, 5/96.
16. *Air Pollution and Daily Mortality* by Sureah H. Moolgavkar, Fred Hutchinson Cancer Research Center, Aug. 1996. John Neill, PHD, Cleveland Dept. of Health, *May 14, 1996 memo to Robert Staib, Director*. Jim Nichols, Plain Dealer, *Study singles out Cleveland over particulate pollution*, May 9, 1996. New York Post editorial, *The environmentalists cry wolf, again*, May 18, 1996
17. Environment Reporter (1996). EPA Considers Option to Drop PM-2.5 Proposal for Particulates, Tighten Existing PM-10 Rule. BNA Current Developments, April 26, 1996, p. 2421-2422.
18. Kentucky Department for Environmental Protection (1996). Toxic Release Inventory Report, 1994 data.
19. Hugh Spencer, KY Institute for Environment and Sustainable Development, Center of Environmental Engineering, University of Louisville (1996). Kentucky Greenhouse Gas Inventory, May 1996.
20. Kentucky Natural Resources and Environmental Protection Cabinet (1995). Kentucky Outlook 2000: Comparative Risk Assessment, draft.
21. US EPA (1993). Respiratory Health Effects of Passive Smoking
22. Kentucky Cabinet for Health Services (1996). Kentucky Behavioral Risk Factor Surveillance Survey, May 1996. In 1993 Kentucky had the highest smoking prevalence in the nation of 30.1%.
23. Air Chek Inc. (1996). Radon Test Result Summary for the State of Kentucky, August 1996.

Acknowledgments

Prepared by Leslie Cole, Executive Director, Environmental Quality Commission with the assistance of Commission staff members Scott Richards, Assistant Director, and Erik Siegel, Research Assistant. EQC would like to thank John Hornback, Diana Andrews, Ken Hines, Jerry Suddith, Diana Hogan, Lona Brewer, Martin Luther, John Lyons, Mark Ritter, and other KY Division for Air Quality staff for their assistance in preparing this report. EQC also extends its appreciation to Richard Everhart and the Jefferson County Air Pollution Control District for providing information for the report. EQC also wishes to thank the NREPC Budget Office and Office of Administrative Hearings; the KY Business Environmental Assistance Program; the Public Service Comm.; Van Bowersox, Ill. State Water Survey; and the Cabinet for Health Services for data used in the report. EQC extends its appreciation to those who reviewed the report including Jonathan Miller, DuPont-DOW; Tom FitzGerald, KY Resources Council; Dr. Hugh Spencer, Univ. of Louisville; Bill Caylor, KY Coal Assn.; Kim Menke, Toyota Motor Manufacturing, U.S.A.; Ralph Hill, Lexmark, International; Carolyn Embry, American Lung Assn.; Ray Dailey, Westvaco; Caryl Pfeiffer and Glen Gibian, Kentucky Utilities Company; and Jim See, American Electric Power. EQC would like to thank Faun S. Fishback for her assistance with editing the report. EQC welcomes comments or corrections to refine and update information in future editions. Any opinions, findings, or conclusions in this publication are those of EQC and do not necessarily reflect the views or policies of the individuals, agencies, or organizations mentioned above. EQC does not discriminate on the basis of race, color, national origin, sex, age, religion, or disability and provides reasonable accommodations upon request.

Printed with state funds. Partial funding was also provided by the State Environmental Goals and Indicator Project, a cooperative agreement between the U.S. EPA and the Florida Center for Public Management to encourage the development and use of environmental indicators.

Kentucky Environmental Quality Commission
14 Reilly Rd.
Frankfort, KY 40601
Telephone: 502-564-2150
Fax: 502-564-4245
E-mail: EQC@mail.nr.state.ky.us
EQC web site: http://www.state.ky.us/agencies/eqc/eqc.html

1996 State of KY's Environment

To receive all seven of the 1996 *EQC State of Kentucky's Environment* Report series send a $10 check, payable to the Kentucky State Treasurer, to:
Environmental Quality Commission
1996 State of KY's Environment Series
14 Reilly Rd.
Frankfort, KY 40601